AMENDMENTS TO CLAIMS

1. (Currently Amended) A method for producing a hologram from a virtual object (6) defined in a three-dimensional geometrical space ~~(O, x, y, z)~~ said method comprising the steps of:

computing (E1-E4) a set of two-dimensional images (80_{nm}) representing the object as seen from respective different viewpoints in the three-dimensional geometrical space, each of said two-dimensional images (80_{nm}) representing the object as seen from one of said different viewpoints,

computing (E5-E6) a set of elementary holograms (90_{nm}), each of said elementary holograms corresponding to one of said two-dimensional images, and

combining (E7) said elementary holograms (90_{nm}) in a combined digital image to form a hologram (9) of the object (6),

wherein each of said two-dimensional images (80_{nm}) is defined by a real function [[(f_{nm}(Y,Z))]] and wherein said step (E5-E6) of computing the elementary holograms for a given two-dimensional image (80_{nm}) comprises the following steps:

converting (E50, E51) the two-dimensional image defined by the corresponding real function into a complex ~~two-dimensional~~ image defined by a complex function,

oversampling (E52) the complex image (82_{nm}),

~~illuminating~~ simulating illumination of the oversampled complex image by an optical wave (DIF) to obtain a diffracted image (84_{nm}),

adding (E54) a complex field representing a reference optical wave (REF) to the resulting diffracted image (84_{nm}) to produce an interference field, and

extracting (E6) amplitude values of the sum of said complex field and the resulting diffracted image (84_{nm}) to produce the hologram (90_{nm}) associated with said given two-dimensional image (80_{nm}).

2. (Previously Presented) A method according to claim 1, wherein said step of computing the set of two-dimensional images includes the following steps:

defining a first geometrical plane (7) in the three-dimensional geometrical space, said first geometrical plane being separate from said object,

defining (E1-E2) a matrix of points (70_{nm}) in said first geometrical plane (7), each of said points corresponding to one of said different viewpoints,

defining a second geometrical plane (8), said second geometrical plane (8) being parallel to said first geometrical plane and preferably located between the object (6) and the first geometrical plane (7), and

projecting (E3-E4) images of the object as respectively seen from said points (70_{nm}) of said matrix onto said second geometrical plane (8), wherein the projected image constitute said two-dimensional images (80_{nm}).

3. (Original) A method according to claim 2, wherein, for each point (70_{nm}) of the matrix, said projection step consists of projecting points (60) of the object (6) onto the second plane (8) along respective straight lines passing through said points of the object and said each point of the matrix.

4. (Previously Presented) A method according to claim 1, wherein said step (E5-E6) of computing the holograms is implemented using a technique employing a Fourier transform.

5. (Canceled)

6. (Currently Amended) A method according to claim 1, wherein said converting step includes the following steps:

determining (E50) amplitudes associated with pixels of the complex ~~two-dimensional~~ image, said amplitudes depending, for each pixel of said image, on the square root of a corresponding intensity value of said real function of the given two-dimensional image defined by said real function, and

associating (E51) a phase with each of said amplitudes so that an amplitude and a phase are defined for each point of the complex image.

7. (Currently Amended) A method according to claim 1, wherein said ~~simulation step (E53) includes the computation of at least one of the following complex transforms: Fourier transform, Walsh transform, Hankel transform, orthogonal polynomial transform, Hadamar transform, Karhunen-Loeve transform, multiresolution discrete wavelet transform, adaptive wavelet transform and a transform consisting of a composite of at least two of the above transforms~~ step of simulating illumination of the oversampled complex image by an optical wave (DIF) comprises the step of calculating said diffracted image, said diffracted image calculating step comprising the steps of:

calculating a convolution product of the oversampled complex image and a function describing said optical wave, wherein the convolution product is obtained by first performing a complex transformation on said oversampled complex image and said function describing said optical wave respectively and then an inverse complex transformation of the product of the transformed complex image and the transformed function describing said optical wave to obtain the diffracted image, wherein said inverse complex transformation is the inverse of said complex transformation.

8. (Currently Amended) A method according to claim 7, wherein said ~~simulation step (E53) consists of computing a convolution of functions which respectively describe said optical wave (DIF) and the oversampled complex image (83_{nm}), by applying an inverse complex transform to the product of the respective complex transforms of said two functions, said inverse complex transform being the inverse of said complex transforms~~ complex transformation is at least one of a Fourier transform, Walsh transform, Hankel transform, orthogonal polynomial transform, Hadamar transform, Karhunen-Loeve transform, multiresolution discrete wavelet transform, adaptive wavelet transform and a transform consisting of a composite of at least two of the above transforms.

9. (Previously Presented) A method according to claim 1, wherein said step (E7) of combining the holograms comprises juxtaposing the holograms (90_{nm}) of the two-dimensional images (80_{nm}) in said combined digital image (9) constituting said hologram (9) of the object (6).

10. (Previously Presented) A method of producing a three-dimensional image from a virtual object (6) defined in a three-dimensional geometrical space (O, x, y, z), comprising the following steps:

producing a hologram (9) of the object (6) by a method according to one of claims 1 to 9,

physically reproducing (E8) said hologram (9) of the object (6) on a spatial light modulator (2), and

illuminating (E8) the spatial light modulator (2) in order to reproduce a three-dimensional image of the object (6) from the hologram (9).

11. (Original) A method according to claim 10, wherein said spatial light modulator (2) comprises a liquid crystal screen having a pixel pitch less than 10 μm and preferably from 1μm to 2 μm in at least two different directions.

12. (Previously Presented) A method according to claim 10, wherein the step of illuminating the spatial light modulator (2) consists of illuminating said spatial light modulator with three optical waves (4a, 4b, 4c) respectively representing the colors red, green and blue (RGB) in turn and in synchronism with reproduction by the spatial light modulator (2) of a sequence of holograms of the object, each hologram corresponding to one of the said three colors, so that a three-dimensional color image of the object (6) is reproduced.

13. (Previously Presented) A method according to claim 10, wherein a sequence of holograms is physically reproduced by the spatial light modulator (2) so as to reproduce animated three-dimensional images of the object (6) after the step of illuminating the spatial light modulator.

14. (Currently Amended) A system for producing a hologram from a virtual object (6) defined in a three-dimensional geometrical space~~ (O, x, y, z)~~, comprising:

memory means (1) for storing the virtual object (6) defined in the three-dimensional geometrical space~~ (O, x, y, z)~~,

first computing means (1) for producing a set of two-dimensional images (80_{nm}) representing the object (6) as seen from respective different viewpoints in the three-dimensional geometrical space, each of said two-dimensional images (80_{nm}) representing the object as seen from one of said different viewpoints;

second computing means (1) for producing elementary holograms (90_{nm}), each of said elementary holograms corresponding to one of said two-dimensional images (80_{nm}), and

combining means (1) for combining said elementary holograms (90_{nm}) in a common digital image to form a hologram (9) of the object (6),

wherein each of said two-dimensional images (80_{nm}) is defined by a real function [[(f_{nm}(Y,Z))]] and wherein the second computing means comprise:

converting means (1) for converting (E50, E51) a given two-dimensional image (80_{nm}) defined by the corresponding real function into a complex ~~two-dimensional~~ image defined by a complex function,

means (1) for oversampling (E52) the complex image,

~~illuminating~~ means for simulating illumination of the oversampled complex image by an optical wave (DIF) to obtain a diffracted image (84_{nm}),

means (1) for adding (E54) a complex field representing a reference optical wave (REF) to the resulting diffracted image (84_{nm}) to produce an interference field, and

means (1) for extracting (E6) values of the amplitude of the sum of said complex field and the diffracted image (84_{nm}) to produce the hologram (90_{nm}) associated with said given two-dimensional image (80_{nm}).

15. (Previously Presented) A system according to claim 14, wherein said first computing means comprise projection computing means (1) for computing a projection of images of said object (6) as seen from respective points (70_{nm}) of a matrix of points in a first geometrical plane (7) separate from the object (6) onto a second geometrical plane (8) which is preferably between the object (6) and the first plane (7) and parallel to the first plane (7) in the three-dimensional geometrical space (O, x, y, z), wherein each of said points of said matrix of points corresponds to one of said different viewpoints.

16. (Original) The system claimed in claim 15, wherein said projection computing means comprise means (1) for computing, for each point (70_{nm}) of the matrix, the projection of points (60) of the object (6) onto the second plane (8) along respective straight lines passing through said points of the object and said point of the matrix.

17. (Canceled)

18. (Currently Amended) A system according to claim 14, wherein said converting means comprise:

means (1) for determining (E50) amplitudes associated with each pixel of said complex ~~two-dimensional~~ image, said amplitudes depending, for each pixel of said image, on the square root of a corresponding intensity value of said real function of the given two-dimensional image defined by said real function, and

means (1) for associating (E51) a phase with each of said amplitudes so that an amplitude and a phase are defined for each point of the complex image.

19. (Currently Amended) A system according to claim 14, wherein said simulator means comprise means ~~(1) for computing one of the following complex transforms: Fourier transform, Walsh transform, Hankel transform, orthogonal polynomial transform, Hadamar transform, Karhunen-Loeve transform, multiresolution discrete wavelet transform, adaptive wavelet transform and a transform consisting of a composite of at least two of the above transforms~~ for calculating said diffracted image by calculating a convolution product of the oversampled complex image and a function describing said optical wave, wherein the convolution product is obtained by first performing a complex transformation on said oversampled complex image and said function describing said optical wave respectively and then an inverse complex transformation of the product of the transformed complex image and the transformed function describing said optical wave to obtain the diffracted image, wherein said inverse complex transformation is the inverse of said complex transformation.

20. (Currently Amended) A system according to claim 19, wherein said ~~simulator means comprise means (1) for computing a convolution of two functions, by applying an inverse complex transform to the product of the respective complex transforms of said two functions, said inverse complex transform being the inverse of said complex transforms~~ <u>complex transformation is at least one of a Fourier transform, Walsh transform, Hankel transform, orthogonal polynomial transform, Hadamar transform, Karhunen-Loeve transform, multiresolution discrete wavelet transform, adaptive wavelet transform and a transform consisting of a composite of at least two of the above transforms</u>.

21. (Previously Presented) A system according to claim 14, wherein the combining means (1) comprise means for juxtaposing the holograms (90_{nm}) of the two-dimensional images (80_{nm}) in said combined digital image (9) constituting said hologram of the object (6).

22. (Previously Presented) A system for producing a three-dimensional image from a virtual object (6) defined in a three-dimensional geometrical space (O, x, y, z), comprising:

a system according to one of claims 14 to 21 for producing a hologram (9) of the object (6),

a spatial light modulator (2) for physically implementing the hologram (9) of the object, and

a light source (4) for illuminating the spatial light modulator (2) in order to reproduce a three-dimensional image of the object (6) from the hologram (9).

23. (Previously Presented) A system according to claim 22, wherein said spatial light modulator (2) comprises a liquid crystal screen having a pixel pitch less than 10 μm in at least two different directions.

24. (Previously Presented) A system according to claim 22, wherein said light source comprises three separate light sources (4a, 4b, 4c) for illuminating the spatial light modulator (2) with three optical waves respectively representing the colors red, green, and blue (RGB) in turn and in

synchronism with the reproduction by the spatial light modulator (2) of a sequence of holograms of the object, each hologram corresponding to one of said three colors so that a three-dimensional color image of the object is reproduced.

25. (Previously Presented) A system according to claim 22, wherein said system for producing a hologram of said object is on a first site, the spatial light modulator (2) and the light source (4) are on a second site and the first and second sites are remote from each other.

26. (Previously Presented) A system according to claim 22, wherein said pixel pitch is between 1μm to 2μm in at least two different directions.